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Safe and Nutritious Seafood in Virginia

Abigail Villalba, Extension Specialist, Virginia Seafood Agricultural Research and Extension Center
Elena Serrano, Assistant Professor, Human Nutrition, Foods and Exercise, Virginia Tech
Andy Sarjahani, Dietetic Intern, Human Nutrition, Foods and Exercise, Virginia Tech
Michael Schwarz, Extension Specialist, Virginia Seafood Agricultural Research and Extension Center
Michael Jahncke, Professor/Director, Virginia Seafood Agricultural Research and Extension Center

Consumers enjoy eating a variety of seafood and can find many choices of fresh or frozen seafood in the refrigerated and freezer cases at the grocery store. The consumption of both domestic and imported seafood continues to rise in the United States, with a 16.5 pounds per capita per year in 2006, up 0.3 pounds from 2005. The United States was the second largest importer of seafood in the world, with an estimated consumer expenditure of $69.5 billion for fishery products in 2006 (NMFS 2006).

Seafood tastes good, is low in saturated fat, is an excellent source of protein and omega-3 fatty acids, and helps in the prevention of heart disease. But consumers want assurance that they are buying safe and good quality products. This publication provides the information you need to help ensure that the seafood you buy and consume is safe and nutritious.

Virginia Seafood Inspection

The seafood industry is regulated and inspected by the Food and Drug Administration (FDA). The FDA requires that seafood processors, including packers and warehouses, implement a program called Hazard Analysis Critical Control Point (HACCP) in conjunction with sanitation programs to ensure seafood safety. The goal of a HACCP program is to identify and control food safety hazards. The FDA also administers the National Shellfish Sanitation Program, with control over growing areas, harvesting, shucking, packing, and interstate transportation of molluscan shellfish such as clams and oysters. Fish and fishery products entering the U.S. must also be in conformance with the U.S. FDA seafood HACCP Regulations (FDA 2001 b).

In Virginia, these responsibilities are carried out by the FDA, the Virginia Department of Agriculture and Consumer Services, the Virginia Department of Health, the Virginia Division of Shellfish Sanitation, and the Virginia Marine Resources Commission. Additionally, Virginia Tech scientists and engineers work with processors to monitor and improve control procedures in shellfish and finfish plants throughout the state. Some Virginia seafood processors also participate under a voluntary HACCP inspection program provided to the industry by the Seafood Inspection Program/National Marine and Fisheries Service of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration. Under this program, seafood processors are inspected for compliance with all applicable food regulations including HACCP and sanitation regulations as well as providing product quality evaluation, grading, and certification services (NMFS/SIP 2008).

Aquaculture Seafood: meeting the demands for seafood

A significant trend in Virginia, across the U.S., and around the world is an increase in aquaculture production. Aquaculture can be defined as the production of plants and animals in a water environment. Typical

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aquaculture products available in most grocery stores with a seafood section include: salmon, catfish, tilapia, clams, oysters, mussels, red drum, yellow perch, and shrimp, to name just a few. In fact, nowadays in a typical seafood display counter, more than half of the products available are derived from aquaculture. Among the many significant benefits associated with aquacultured products are that they are often grown under strictly controlled environmental conditions, are monitored regularly for animal health issues during the production cycle, and in the case of most fish and shrimp aquaculture, are fed commercially produced healthful diets throughout their production cycle. Another significant benefit from aquaculture products is that since production is generally year-round, the product is also available year-round. Aquaculture products produced in the U.S. are closely monitored and regulated by both state and federal agencies to maintain product quality and safety to the consumer.

Labeling

The federal seafood-labeling law known as Country of Origin Labeling, or "COOL" went into effect in April 2005. It requires that supermarkets label fresh and frozen seafood with its country of origin and whether it is a "wild-caught" or "farm-raised" product. This mandate, regulated by the USDA, currently involves only processed seafood items sold at retail. It does not apply to seafood sold at restaurants and does not apply to foods that are "substantially altered" (i.e. cooked, cured, or smoked) or when they are an ingredient in a processed food item (USDA/AMS 2005). Knowing where seafood comes from can help consumers make informed selections as well as allow them to understand the global nature of the seafood supply.

Seafood Hazards

Seafood may be contaminated with food-borne illness-causing microorganisms such as bacteria, viruses and/or parasites. Some bacteria (e.g. *Vibrio* spp.) are naturally occurring in the environment and are unrelated to pollution; others, such as Salmonella and viruses, are present as a result of pollution in the waters.

There are certain species of fish that, if not kept cold or if transported without refrigeration, can produce histamine. Histamine poisoning, also known as scombroid poisoning, results from the ingestion of fish containing high concentrations of histamine. The illness, which can cause headaches and itching of the skin, among other symptoms, is usually short in duration with no long-term health consequences (FDA 2007). The best assurance to prevent histamine formation is to keep fish cold or iced from the time it is harvested until it is ready to cook.

Some finfish may contain parasites. Parasites in finfish are only considered a hazard when the product is going to be consumed raw, such as sushi and sashimi, or undercooked. Cooking or freezing fish kills the parasites that may be present (FDA 2001a). Consumption of raw or undercooked shellfish such as oysters, clams, and mussels can cause food-borne illness, especially in consumers with weak immune systems or other underlying health problems (i.e. liver disease, diabetes, cancer, or stomach problems).

Inadequate cooking and cross-contamination of cooked foods with the raw product or from unwashed hands are contributors to food-borne disease outbreaks (CDC 2008). Seafood prepared and held without proper refrigeration can allow bacteria to grow. Cooking seafood and cleaning and following good sanitation practices are important to prevent illness. Once seafood is cooked, preventing contamination with dirty equipment or utensils or raw foods is also essential.

Consumers play an important role in helping to ensure the quality and safety of seafood. Purchasing products from reputable sources and following recommended storage guidelines and safe food handling practices will help to ensure seafood that is not only safe but nutritious.

How to Select Fresh and Frozen Fish and Shellfish (from Hicks 1996)

Purchasing

Purchase seafood from reputable sources – markets and grocers with a history of providing safe food to customers.

- The market or seafood section of the grocery store should look and smell clean. Employees should wear clean clothes and use disposable gloves when handling raw seafood and should be knowledgeable about the product.
- Fresh raw seafood should be properly refrigerated or placed in a bed of ice when displayed. Fish should be arranged with the bellies down so that melting ice drains away. Cooked or smoked ready-to-eat seafood should not be displayed in the same display case as raw seafood.

Frozen Seafood

- Do not purchase frozen seafood in torn or damaged packages. The product should be frozen solid with no sign of ice crystals or thawing.
- Frozen prepared shellfish, such as crab cakes or breaded shrimp, clams, or oysters, should have no signs of freezer burn or discoloration on the surface and have no objectionable odor.
- Packaged breaded and unbreaded products should have a clean and uniform appearance. Individual pieces should separate easily with the breading intact.
- "Fresh Frozen" indicates that the seafood was frozen while fresh; "Previously Frozen" means that the fresh seafood was frozen and thawed for retail sale. The quality and safety of frozen seafood is comparable to fresh seafood.
- Purchase seafood at the end of your shopping trip, just prior to checkout. Make sure that the seafood is securely packaged to prevent raw juices from contaminating other foods such as fresh fruits and vegetables.
- If your trip to the market or grocery store will exceed 30 minutes, take a cooler lined with ice or use ice packs to keep the seafood cold.

Fresh Whole Fish and Fish Fillets

- When purchasing fresh whole fish, look for eyes that are clear and bulge slightly. The flesh of whole fish and fillets is firm and shiny. The gills of fresh whole fish are bright red or pink and free of slime. The skin is shiny with scales that adhere tightly.
- There is no discoloration or darkening around the edges of the fish, including the gills. The fish smells fresh, not sour, fishy, or ammonia-like.
- Fresh fish fillets are firm and elastic with no evidence of browning around the edges. The flesh is translucent with no evidence of bruising or reddening. Flesh that "springs back" when pressed is a sign of freshness.

Shellfish

When purchasing shellfish, look for the following characteristics:

- Purchase raw shellfish only from reputable markets. If in doubt, ask the seafood market personnel to show you the certified shipper's tag that accompanies "shell on" products or check the shipper number on shucked oyster containers.
- Shells of live clams, oysters, and mussels are moist and tightly closed. Do not purchase live shellfish with cracked shells or shells that will not close when tapped.
- The meat of fresh-shucked clams, oysters, and mussels is plump and covered with liquid that is clear to slightly milky and free of strong odors.
- The meat of fresh scallops exhibits a firm texture, sweet odor, and a creamy color.
- Live crabs and lobsters move within the tanks and the tails curl tightly underneath the body. The tails of lobsters do not hang down when the lobster is picked up.
- Cooked lobsters or crabs in the shell are bright red and have no off-odor. Lobster meat is snowy white with red tints, while crabmeat is white with red to brown tints.
- Raw shrimp is firm, exhibits a mild odor, and has translucent shells with a light pink tint, and there are no black spots or patches on the shell or meat.
- Whole squid have clear, full eyes. The skin is cream colored with reddish brown spots.

Smoked Fish

- Smoked seafood exhibits a firm, springy texture, glossy surface, and a smoky odor with no signs of dried blood or mold on the product.
- Packaged smoked seafood appears fresh and moist. The package should be airtight and not damaged.

Cooked Ready-To-Eat Seafood

- Cooked ready-to-eat seafood can include cooked crabmeat, cooked shrimp, and smoked fish. Contamination with illness-causing bacteria can make cooked seafood unsafe. Contamination can occur when store personnel use poor handling techniques such as using the same utensils to handle raw and cooked seafood or using bare hands to handle the cooked products. Do not purchase cooked seafood if you observe poor handling techniques.

Simulated Seafood Products (Surimi)

- Simulated seafood products are moist and have a fresh appearance without traces of browning or discoloration.
- Simulated crabmeat, lobster meat, shrimp, scallops, and other seafood products have a fresh and mild odor.

Storing

- After purchasing, store seafood immediately in the refrigerator or freezer. If you plan to consume fresh seafood within two days of purchase, cover the seafood and store it on the bottom shelf of the refrigerator separately from cooked and ready-to-eat foods. Be sure to use fish within one to two days after purchase. When freezing fresh seafood, package in moisture-proof freezer paper or wrap to prevent freezer burn.
- Pack dressed fish on ice in the refrigerator. Empty melted ice regularly and replenish ice as needed. Rinse fish that are not prepackaged under cold running water and pat dry with an absorbent paper towel. Wrap the fish in moisture-proof paper or plastic wrap and place in a plastic bag. Seal fish fillets in plastic bags or containers and cover with ice in pans or trays. Store in refrigerator no longer than two days.
- Store live shellfish in a shallow container lined with damp towels or moistened paper towels. Never place live shellfish in water or in an airtight container. Discard shells that are not closed or don't close when tapped.
- Store shrimp, squid, and shucked shellfish in a leak-proof bag or plastic container.
- Store cooked, picked lobster meat and crabmeat in a moisture-proof bag or airtight container.

Recommended storage times for fresh and frozen seafood are presented in the Seafood Storage Guide on the next page.

Preparing

When preparing seafood, follow these safe food-handling guidelines:

- Never thaw frozen foods at room temperature. Thaw frozen seafood on the bottom shelf of the refrigerator. If the seafood needs to be thawed quickly, seal in a plastic bag and run cold water over the surface. Thawing seafood in the microwave oven is permissible if the food is to be cooked immediately. Use the microwave "defrost" setting and stop the defrost cycle while the fish is still icy but pliable. If thawing is not necessary, double the cooking time.
- When thawing frozen fish that comes in a vacuum-sealed package, remove it from the package, cover or wrap, and thaw it under refrigeration immediately before use. Do not thaw product while it is still inside the vacuum-sealed package.
- Wash your hands thoroughly before and after handling raw seafood.
- Keep raw seafood separate from cooked and ready-to-eat food. Never place cooked seafood on a plate previously used for raw seafood without first washing the plate with soap and water.

Seafood Storage Guide

Product Fish Fillets, Steaks	Purchased frozen; maintained frozen	Purchased fresh; frozen at home	Purchased fresh or thawed; maintained in refrigerator
Lean			
Cod, Flounder, Haddock, Halibut	**10-12 mos**	**6-8 mos**	**1-1 1/2 days**
Pollock, Ocean Perch, Sea Trout, Rockfish, Pacific Ocean Perch	**8-9 mos**	**4 mos**	**1-2 days**
Fat			
Mullet, Smelt	**6-8 mos**	**N/A***	**1-1 1/2 days**
Salmon (gutted)	**7-9 mos**	**N/A***	**1-1 1/2 days**
Shellfish			
Dungeness Crab	**6 mos**	**6 mos**	**5 days**
Snow Crab	**6 mos**	**6 mos**	**5 days**
King Crab	**12 mos**	**9 mos**	**7 days**
Blue Crab cooked, whole	**N/A***	**N/A***	**2-3 days**
Blue Crab meat – fresh	**N/A***	**4 mos**	**5-7 days**
Blue Crab meat – pasteurized	**N/A***	**N/A***	**6 mos (use 2-3 days after opening)**
Crab – Cocktail claws	**N/A***	**4 mos**	**5 days**
Shrimp, Scallops	**9 mos**	**5 mos**	**4 days**
Oysters live	**N/A***	**N/A***	**7 -10 days**
Oysters – shucked	**N/A***	**N/A***	**4-7 days**
Clams, Mussels live	N/A*	**N/A***	**2-3 days**
Clams – shucked	**N/A***	**N/A***	**5 days**
Crab, Lobster – live	**N/A***	**N/A***	**1-2 days****
Lobster – Tail meat	**8 mos**	**6-8 mos**	**4-5 days**
Squid	**8-9 mos**	**4 mos**	**1-1 1/2 days**
Surimi seafoods	**10-12 mos**	**9 mos**	**2 weeks**
Breaded Products			
Shrimp	**10-12 mos**	**6-8 mos**	**N/A***
Scallops	**16 mos**	**10 mos**	**N/A***
Fish Portions and sticks	**18 mos**	**N/A***	**N/A***
Smoked Fish			
Herring	**N/A***	**2 mos**	**3-4 days**
Salmon, Whitefish	**N/A***	**2 mos**	**5-8 days**

Source: National Fisheries Institute N/A - not applicable or not advised **recommended cooking the day of purchase*

- Marinate seafood in the refrigerator. Discard marinade after use.
- Clean and sanitize kitchen counters, cutting boards, equipment, and utensils before and after preparing seafood.

Cooking

It's always best to cook seafood thoroughly to minimize the risk of food-borne illness. Cook seafood to an internal temperature of 145°F for 15 seconds (FDA 2005). These temperatures ensure that food-borne bacteria have been destroyed. Use a meat thermometer to determine doneness. If you do not have a meat thermometer, determine doneness when the meat flakes easily and the center is no longer translucent (raw) in appearance. The flesh will be opaque throughout its thickness.

- The 10-minute rule

  When baking, broiling, grilling, steaming, and poaching filets, steaks, or whole fish, cook for 10 minutes per inch of thickness at 400°F to 450°F, turning the fish halfway through the cooking time. Add 5 minutes if cooking the fish in foil or in a sauce. Do not apply the 10-minute rule to microwave cooking or deep frying (Virginia Marine Products Board 2008).
- Shrimp, lobster, and crabmeat should be opaque when cooked. Scallops should be milky white to opaque and firm.
- It normally takes 3 to 5 minutes to boil or steam one pound of medium-size shrimp and 3 to 4 minutes to cook scallops. Boil lobsters in water at a rolling boil for 10 to 12 minutes per pound of lobster. Place crabs in a crab pot and steam approximately 25 minutes per two dozen crabs.
- Clams, mussels, and oysters are done when the shells open (usually 4 to 9 minutes from start of steaming). Discard shellfish with shells that do not open. Live clams, mussels, and oysters should be scrubbed with a vegetable brush prior to cooking.
- Shucked shellfish are plump and opaque when fully cooked. Boil or simmer oysters for at least 3 minutes, fry in oil for at least 10 minutes at 375°F, or bake at 450°F for at least 10 minutes.
- Follow the manufacturer's directions on the package for cooking frozen, packaged seafood such as breaded fillets. If microwaving, rotate the seafood dish or stir several times to insure even cooking. Check the temperature of seafood in several locations with a meat thermometer.

Eating raw seafood

If you choose to eat seafood raw, eat fish that has been previously frozen so that parasites that may be present are killed. People at risk for food-borne illness such as pregnant women, young children, older adults, and people with a chronic illness should not eat raw or partially cooked fish and shellfish such as oysters.

Serving Seafood

When serving, do not contaminate the cooked seafood with unwashed hands. Utensils and food contact surfaces should be clean and sanitary.

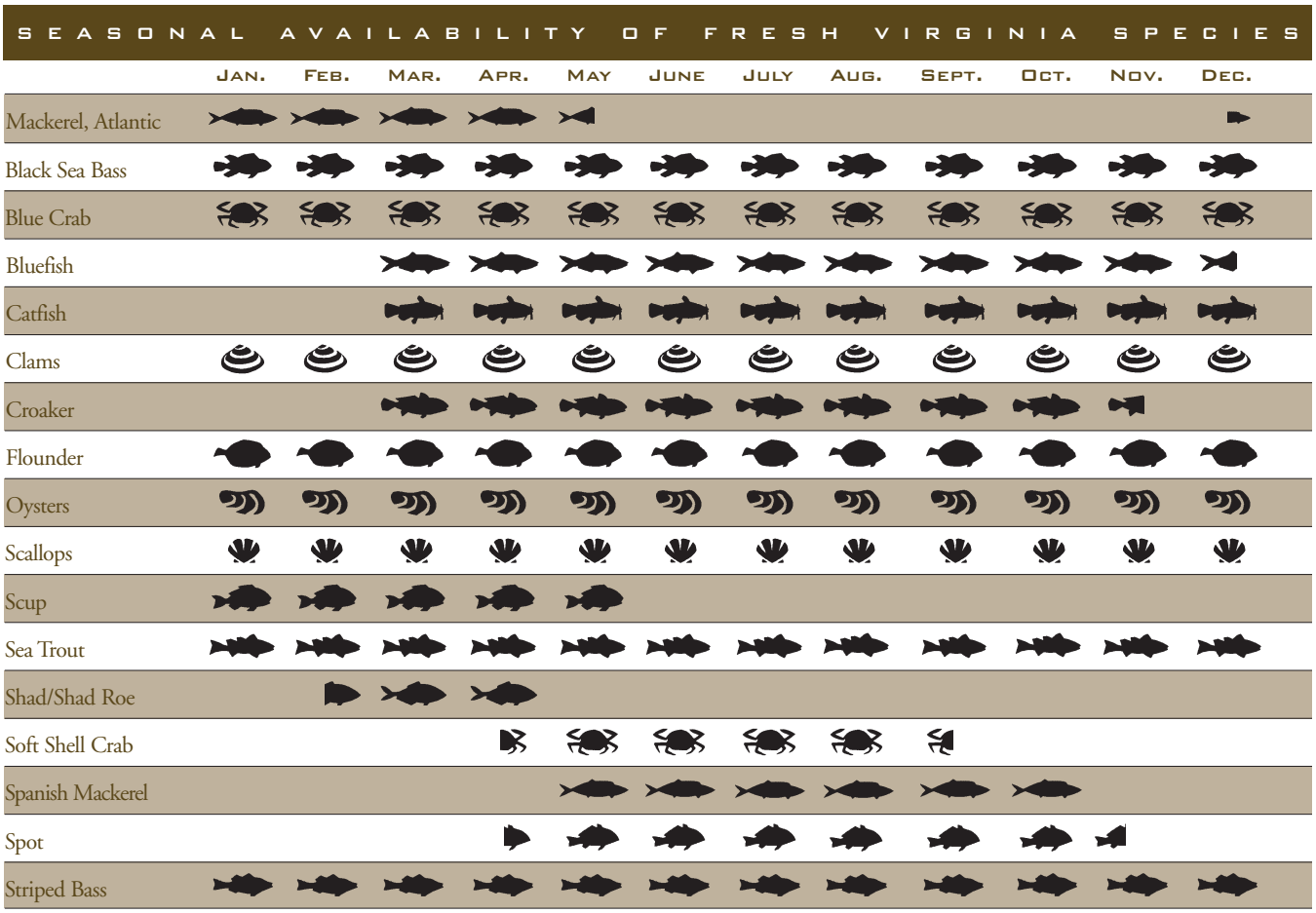
- Don't leave cooked seafood outside the refrigerator for more than two hours (or less than one hour if temperatures are above 90°F). Bacteria can grow rapidly in the DANGER ZONE temperatures between 41°F and 135°F (FDA 2005). Keep hot foods "hot" and cold foods "cold."
- Put leftovers in clean, shallow containers and refrigerate immediately. Do not keep leftovers more than two days. Discard them if they have an unpleasant odor or appearance. When in doubt, throw it out!
- Reheat any leftover to an internal temperature of at least 165°F before serving.

Seasonal Availability

In Virginia, the availability of fresh seafood will fluctuate during the year. Become familiar with the seasonal availability and pricing of fish and shellfish in your area. This will help you to purchase seafood at affordable prices. Another alternative to using fresh seafood is to use frozen seafood. Many frozen seafoods, are caught and frozen at sea, ensuring their best quality. The following chart can be used as a guide for purchasing fresh seafood in season.

Benefits of Eating Seafood

Seafood not only tastes great, but is an important part of a healthy diet. It is an excellent source of protein, is low in saturated fat, and a good source of omega-3 fatty acids. Omega-3 fatty acids are a type of polyunsaturated fatty acid that cannot be made by the body and must be obtained from the diet. They are called essential fatty acids. Omega-3 fatty acids affect the body differently than other fatty acids or fats – including saturated, mono-unsaturated, and even polyunsaturated omega-6 fatty acids.



Source: Virginia Marine Products Board

Levels of Omega-3 Fatty Acids in Some Fish and Shellfish

Product	grams per 3-oz. serving
Canned tuna (light)	0.26–0.73
Pollock	0.46
Salmon (fresh/frozen)	0.68–1.83
Cod	0.13–0.24
Catfish	0.15–0.20
Flounder or sole	0.43
Grouper	0.21
Mahi mahi	0.12
Herring	1.71–1.81
Crabs	0.34–0.40
Scallops	0.17
Oysters	0.37–1.17
Shrimp	0.27
Clams	0.24

Source: American Heart Association

Omega-3 fatty acids are found in fatty fish like mackerel, lake trout, herring, sardines, albacore tuna, and salmon, and in plant products such as flaxseed, tofu, soybean, oil, canola oil, and nuts (such as walnuts). There are three different types of omega-3 fatty acids: Eicosapentaenoic acid (EPA), docosahexaeonoic acid (DHA), and alpha-linolenic acid (ALA).

The ones that are found in fish and seafood are EPA and DHA. Research suggests that a diet rich in fish and high in EPA and DHA may help:

- decrease triglyceride levels
- decrease growth rate of atherosclerotic plaque
- decrease risk of arrhythmias
- lower blood pressure

DHA has been shown to improve pregnancy and birth outcomes.

Eat the pyramid way

MyPyramid is a general guide to help Americans eat a well balanced diet. Seafood is located in the "Meat and Beans" group. Depending on the number of calories you need per day, based on your age, gender, and physical activity level, adults should eat between 5 and 6 ounces of meat or the equivalent per day. The American Heart Association recommends that you eat fish at least twice a week to get plenty of omega-3 fatty acids in your diet. Supplements of fish oil in large quantities are not recommended, since omega-3 fatty acids can thin the blood and increase the risk of a stroke.

What about cholesterol?

Most fish and shellfish have approximately 70 milligrams of cholesterol in 3 ounces of cooked fish. This is similar to cooked beef, pork, lamb, or dark meats of chicken and turkey.

What about mercury?

For most people, the mercury from eating fish and shellfish does not pose a risk. But, some fish and shellfish contain higher levels of mercury that may harm an unborn baby or young child's developing nervous system. As a result, the FDA and the Environmental Protection Agency (EPA) advise women who may become pregnant, pregnant women, nursing mothers, and young children to follow the following recommendations:

1. Do not eat shark, swordfish, king mackerel, or tilefish because they contain high levels of mercury.
2. Eat up to 12 ounces (two average meals) a week of a variety of fish and shellfish that are lower in mercury.
   i. Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.
   ii. Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
3. Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, you can eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don't consume any other fish during that week.

Follow these same recommendations when feeding fish and shellfish to your young child, but serve smaller portions.

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More Information on Seafood Safety and Nutrition is available at:

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This publication was originally authored by Tim Roberts and Kathleen M. Stadler.